

**REMARKS**

Claims 10-15 are presently pending in the application.

Claim 10 has been amended to delete (E) polysulfides as possible additives. New claims 12 and 13 recite thiocarbamate additives having formula (3) or (4), which are supported in the specification at least at page 8, last 5 lines to page 9, line 4. New claims 14 and 15 remove dithiocarbamates as possible additives. No new matter has been added by these amendments, and entry is respectfully requested.

In the Office Action, the Examiner has rejected claims 10-11 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,121,209 of Watts et al. ("Watts") in combination with U.S. Patent No. 5,792,731 of Ichihashi et al. ("Ichihashi") or over U.S. Patent No. 5,443,744 of Bloch et al. ("Bloch") in view of Ichihashi. Applicant respectfully traverses these rejections and the arguments in support thereof as follows, and respectfully requests reconsideration and withdrawal of the rejections.

**The Presently Claimed Invention**

As previously explained on the record, the purpose of the presently claimed invention is to provide a lubricating oil composition for automatic transmissions which is capable of sustaining excellent  $\mu$ -V characteristics that are always maintained in a positive gradient, even after the composition has been used in a belt-type CVT (continuously variable transmission) for an automobile for a long period of time. Such a positive gradient will prevent the occurrence of scratch noises.

Previously, it was found that in automobiles having belt type CVTs, the CVTs made scratch noises due to a fluctuation in the rotation of the driven pulley when starting the automobile. Such a fluctuation occurs when the change in the friction coefficient ( $\mu$ ) between the belt and the element over the change in the slipping velocity (V), i.e. the  $\mu$ -V characteristic, is in a negative gradient. Conventional automatic transmission fluids did not always exhibit excellent  $\mu$ -V characteristics in belt-type CVTs, particularly when they were used for long

periods of time. Accordingly, the change in the  $\mu$ -V characteristic became larger and the scratch noises occurred more frequently.

Applicant has discovered that these problems may be solved by adjusting the mass ratios of specific elements, such as phosphorus, calcium, boron, and sulfur, which are contained in a lubricating oil composition, by maintaining specific concentrations of phosphorus, sulfur derived from a base oil, and sulfur derived from sulfur-based additives, and by including specific sulfur-based additives in the lubricating oil composition.

The advantages of the presently claimed composition are shown in Tables 1 to 4 of the present application. Specifically, it can be seen that the inventive compositions prepared in Examples 1 to 6 exhibited positive gradient  $\mu$ -V characteristics, whereas all of the compositions described in Comparative Examples 1 to 7 exhibited negative gradient  $\mu$ -V characteristics. Further, comparing Example 1 with Comparative Examples 6 and 7 in Table 4, the claimed composition maintained good positive gradient  $\mu$ -V characteristics even after it had been deteriorated by oxidation, thus corresponding to an oil which had been used for a long period of time.

*Rejection Under § 103(a) Based on Watts in view of Ichihashi*

The Examiner maintains that Watts teaches lubricating oil compositions for use in automatic transmissions which contain a major amount of lubricating oil and minor amounts of (A) a phosphoric acid-containing compound and (B) an ashless antioxidant. Watts allegedly teaches that the preferred range of component (A) corresponds to approximately 0.02 to 0.04 mass percent phosphorus in the oil, and also that a source of boron is desirably present in the oil composition, which may be in the form of borated dispersants, borated amines, borated alcohols, borated esters, or alkyl borates. The Examiner acknowledges that Watts does not teach adding calcium-based additives and at least one sulfur-based additive selected from dithiocarbamates other than metal dithiocarbamates, dithiophosphates other than metal dithiophosphates, trithiophosphites, polysulfides and derivatives thereof as claimed. However, the Examiner contends that Watts also allows for the addition of other additives to the oil compositions, including extreme pressure agents and detergents.

The Examiner further argues that Ichihashi teaches that sulfur-based extreme-pressure additives, including olefin polysulfides, dihydrocarbyl polysulfides and thiocarbamates, and alkaline-earth metal-based detergents, including sulfonates, phenates, salicylates, and phosphates, are conventional additives to lubricating oil compositions suitable for use in transmissions. The Examiner thus concludes that it would have been obvious to one skilled in the art at the time of the invention to have added the sulfur-based extreme pressure additives and alkaline-earth metal-based detergents of Ichihashi to the lubricating oil compositions of Watts if so desired, and that such a combination would meet the claimed limitations. The Examiner takes the position that although mass ratios of phosphorus:calcium:boron:sulfur are not specifically set forth in Watts, the amounts set forth in compounds containing these elements would result in lubricant compositions which meet the claimed ratio. Applicant respectfully traverses this rejection as follows.

As previously described on the record, Watts teaches a lubricating oil composition comprising a major amount of a lubricating oil and minor amounts of (A) phosphoric acid and (B) di-nonyl-diphenylamine, which are taught to improve the oxidation stability of the composition. However, the invention of Watts is not designed to provide excellent  $\mu$ -V characteristics so as to always be maintained in a positive gradient in belt type CVTs to prevent the occurrence of scratch noises even after being used for a long period or time. Since Watts does not acknowledge the need to maintain excellent  $\mu$ -V characteristics or a positive gradient thereof, there would have been no motivation to adjust the parameters (such as sulfur content) which are necessary to obtain such results.

Further, as acknowledged by the Examiner, Watts does not teach or suggest the claimed sulfur-based additive which is selected from the group consisting of claimed components (B) to (D) and derivatives thereof. Watts teaches that a variety of different additives may be included, and the Examiner argues that the claimed additives are taught by Ichihashi. To the contrary, the claimed sulfur-based additives may be (B) dithiocarbamates other than metal dithiocarbamates, (C) dithiophosphates other than metal dithiophosphates, (D) trithiophosphites, and derivatives thereof. Ichihashi discloses a variety of sulfur-based additives including only one dithiocarbamate, zinc dithiocarbamate (col. 3, lines 36-37), which is a metal dithiocarbamate.

Ichihashi does not teach dithiocarbamates other than metal dithiocarbamates as claimed. Furthermore, Ichihashi does not teach or suggest dithiocarbamates represented by formulas (3) and (4) as recited in claims 12 and 13, nor the dithiophosphates and trithiophosphites recited in claims 14 and 15. Accordingly, even the proposed combination of references would not teach or suggest all of the claimed elements. Additionally, there would have been no suggestion based on the proposed combination that the claimed sulfur-based additives would have provided the results exhibited by the presently claimed invention, such as improved  $\mu$ -V characteristics which prevent scratch noises.

For all of these reasons, reconsideration and withdrawal of the § 103(a) rejection based on Watts in view of Ichihashi are respectfully requested.

*Rejection Under § 103(a) Based on Bloch in view of Ichihashi*

The Examiner maintains that Bloch teaches lubricating oil compositions, suitable as automatic transmission fluids, which contain a base oil and the reaction product of a phosphating agent and a thioalcohol. Bloch allegedly teaches that the reaction product may be added to the base oil in an amount corresponding to approximately 0.02 to 0.04 mass percent phosphorus in the oil. A boron source may allegedly be added, including borated dispersants, borated amines, borated alcohols, borated esters or alkyl borates, such that a molar ratio of boron to the phosphorus in the reaction product is preferably 0.5 to 2.0. The Examiner acknowledges that Bloch does not teach or suggest adding calcium-based additives and at least one sulfur-based additive selected from dithiocarbamates other than metal dithiocarbamates, dithiophosphates other than metal dithiophosphates, trithiophosphites, polysulfides and derivatives thereof as claimed.

However, The Examiner argues that Bloch teaches that the lubricating oil compositions may contain one or more additives, including extreme pressure agents and detergents. Therefore, based on the alleged teachings of Ichihashi, discussed above, the Examiner concludes that it would have been obvious to have included the sulfur-based extreme pressure additives and alkaline-earth metal based detergents of Ichihashi in the lubricating oil compositions of Bloch, and that such a combination would meet the claimed limitations. The Examiner takes the

position that although mass ratios of phosphorus:calcium:boron:sulfur are not specifically set forth in the prior art, the amounts set forth in compounds containing these elements would result in lubricant compositions which meet the claimed ratio. Applicant respectfully traverses this rejection as follows.

As previously described on the record, Bloch teaches a lubricating oil composition containing a base oil and the reaction product of a phosphating agent and a thioalcohol. Bloch teaches that such an additive is non-aggressive to silicone-based seals, and is also an effective antiwear agent when used in lubricating oils. However, the invention of Bloch is not designed to provide excellent  $\mu$ -V characteristics so as to always be maintained in a positive gradient in belt type CVTs to prevent the occurrence of scratch noises even after being used for a long period or time. Since Bloch does not acknowledge the need to maintain excellent  $\mu$ -V characteristics or a positive gradient thereof, there would have been no motivation to adjust the parameters (such as sulfur content) which are necessary to obtain such results.

Further, as acknowledged by the Examiner, Bloch does not teach or suggest the claimed sulfur-based additive which is selected from the group consisting of claimed components (B) to (D) and derivatives thereof. Bloch teaches that a variety of different additives may be included, and the Examiner argues that the claimed additives are taught by Ichihashi. To the contrary, the claimed sulfur-based additives may be (B) dithiocarbamates other than metal dithiocarbamates, (C) dithiophosphates other than metal dithiophosphates, (D) trithiophosphites, and derivatives thereof. Ichihashi discloses a variety of sulfur-based additives including only one dithiocarbamate, zinc dithiocarbamate (col. 3, lines 36-37), a metal dithiocarbamate.

Ichihashi does not disclose dithiocarbamates other than metal dithiocarbamates as claimed. Furthermore, Ichihashi does not teach or suggest compounds represented by formulas (3) and (4) as recited in claims 12 and 13 nor the dithiophosphates and trithiophosphites recited in claims 14 and 15. Accordingly, even the proposed combination of references would not teach or suggest all of the claimed elements. Additionally, there would have been no suggestion based on the proposed combination that the claimed sulfur-based additives would have provided the

results exhibited by the presently claimed invention, such as improved  $\mu$ -V characteristics which prevent scratch noises.

For all of these reasons, reconsideration and withdrawal of the § 103(a) rejection based on Bloch in view of Ichihashi are respectfully requested.

In view of the preceding Amendments and Remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,  
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